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CORRIGENDUM TO "EVALUATION OF SURFACE FLUX PARAMETERIZATIONS WITH LONG-TERM ARM OBSERVATIONS"

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Corrigendum to "Evaluation of Surface Flux Parameterizations with Long-Term ARM Observations"

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We regret to acknowledge that in our original article (Liu et al., 2013), incorrect results on the Eta and PX scheme were used in Figures 11, 12 and 15, which also result in some incorrect subsequent discussions in Sections 4 and 6. This corrigendum serves to correct these errors in the order of their occurrence in the original paper.

With Figure 11 corrected, the corresponding discussion on Page 787 in Section 4b (5) is accordingly modified as:

"Figure 11 further compares the diurnal variations of the momentum (panel a), sensible heat flux (panel c) and latent heat flux (panel e), respectively, in order to examine the temporal dependence of the parameterizations' performance. Also shown in Figs. 11b, d and f are the diurnal variations of the corresponding standard deviations, respectively. Figure 11a shows that in correspondence with the excellent statistical agreement between the parameterized and EC momentum fluxes (Fig. 2), all the parameterizations capture the diurnal variations to different degrees. All the schemes overestimate the EC-observed momentum flux during the late morning and afternoon, while the GISS and GFDL schemes produce the relatively largest standard deviations, as shown in Fig. 11b.

Figure 11c shows that all the parameterizations qualitatively capture, but quantitatively magnify, the diurnal cycle of the EBBR and EC-observed sensible heat fluxes. The magnification of the diurnal cycle differs among the parameterizations. Similar patterns of behavior hold for the diurnal variation of the corresponding standard deviations. Figure 11e indicates that all the schemes are able to qualitatively capture the observed diurnal variation of the latent heat flux. It is noteworthy that the inter-scheme differences are somewhat larger than the two observational sets, suggesting that either EBBR or EC observations can be used to assess parameterized diurnal cycles of sensible and latent heat fluxes."

With Figure 12 corrected, accordingly, the paragraph on Page 788 in Section 4b (6) is changed as:

"Figure 12 compares the seasonal variations of the momentum (panel a), sensible heat flux (panel c) and latent heat flux (panel e), as well as the seasonal variations of the corresponding standard deviations (panels b, d and f), respectively. Figures 12a and b show that the seasonal variations of the parameterized and observed momentum fluxes are not that evident. For the sensible heat flux, Figs. 12c and d indicate all the schemes capture the seasonal variations of the EC and EBBR observations well in terms of both monthly mean and standard deviation, but the schemes significantly overestimate the EC and EBBR observations in the monthly mean. In Figs. 12e and f, the schemes also capture the seasonal variations of the EC and EBBR-observed latent heat fluxes well. It is noteworthy that the EC and EBBR observations reach their maxima around June and July whereas the parameterized fluxes peak in August. The lag of the parameterized latent heat fluxes is probably due to the fact that the saturation surface specific humidity at the surface skin temperature, not the actual surface specific humidity, is used in the parameterizations. More study is needed to improve the latent heat flux parameterization."

Figures 15(b) and (c) are corrected, too.

All the corrections also result in some changes in Page 794 in Section 6 (Conclusions). The correct description should be:

"Statistical analysis shows that among the quantities examined (momentum flux, sensible heat flux, latent heat flux, Bowen ratio, and evaporation fraction), the best parameterized is the momentum flux. All six SFP schemes perform well with parameterized momentum fluxes with only a small discrepancy between the different schemes. Nevertheless, there are still differences in the functional dependence on stability, suggesting the need for further improvement.

The sensible and latent heat fluxes observed by the EBBR and EC systems are in reasonably good agreement with each other, although the discrepancy is still noteworthy. The parameterized sensible heat and latent heat fluxes compare poorly with the corresponding EC observations and all six of the SFP schemes underestimate the sensible heat flux when the observed fluxes are positive. Relatively, the three schemes used in the GCMs produce better estimates for the latent heat flux than do those used in the WRF model. Furthermore, all the parameterization schemes tend to exaggerate the magnitude of the diurnal variation of the sensible heat flux, although they qualitatively capture the diurnal cycle. All the schemes also qualitatively reproduce the diurnal cycle of the latent heat flux.

All of the parameterization schemes capture the seasonal variations of the sensible and latent heat fluxes, but they significantly overestimate the sensible heat flux in all months. Moreover, the seasonal maximum of the parameterized latent heat fluxes is lagged for about 1 month compared to the EC and EBBR observations. The errors in the parameterized sensible and latent heat fluxes are further magnified when they are converted into their respective Bowen ratio or evaporative fraction, presenting higher accuracy requirements for the SFP schemes."

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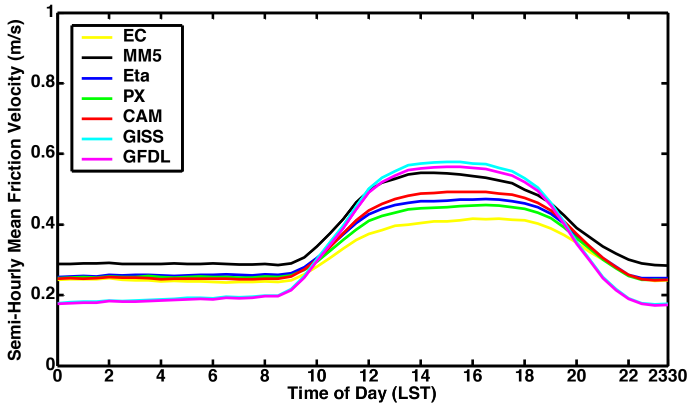
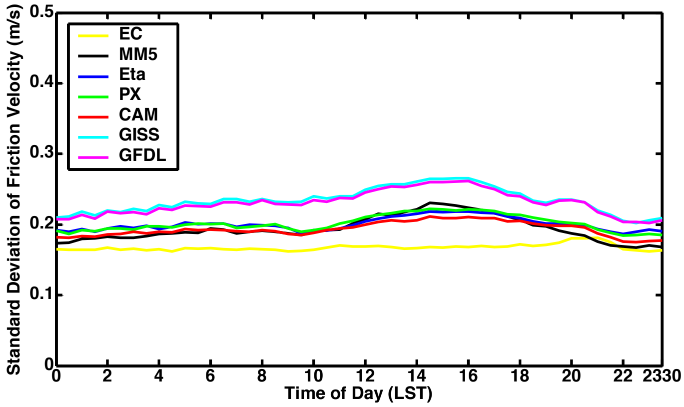
Reference:

Liu, G., Y. Liu, and S. Endo, 2013: Evaluation of surface flux parameterizations with long-term ARM observations. *Mon. Wea. Rev.*, **141**, 773–797.



(a)



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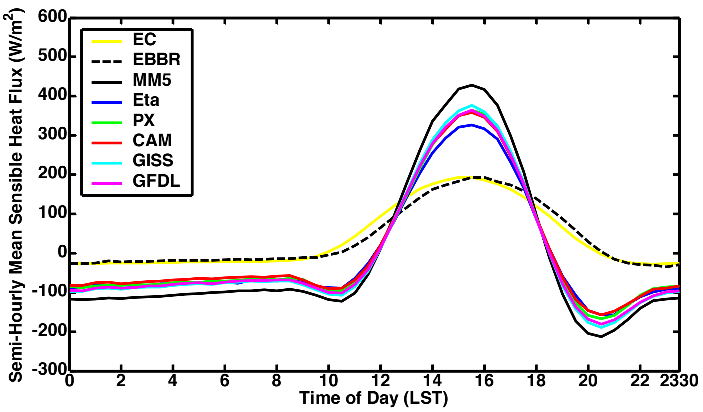

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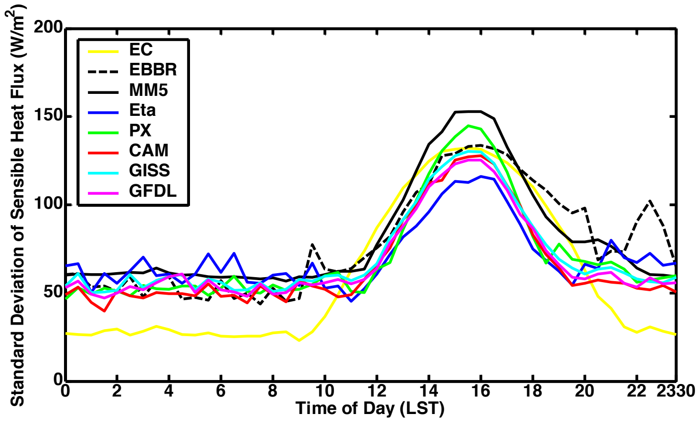

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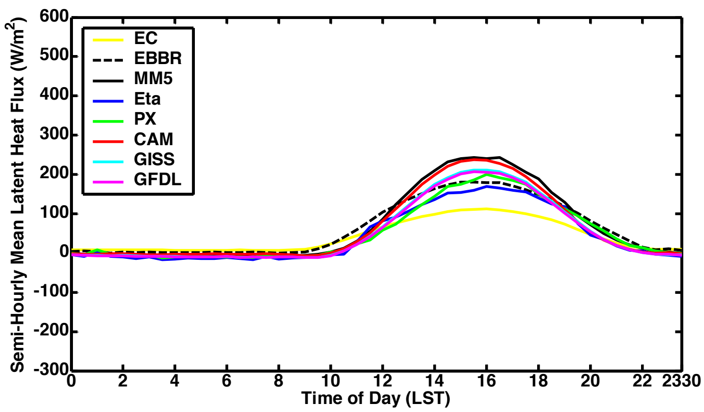
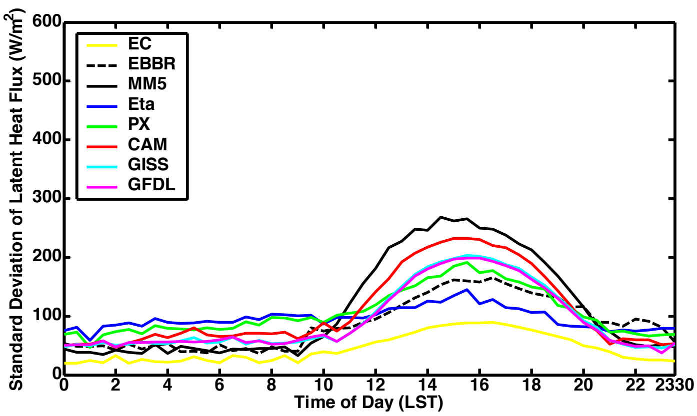


(e)



(f)

Figure 11. Comparison of diurnal variation of the surface turbulent fluxes between the parameterizations and EC observations: (a) semihourly mean of the momentum flux (friction velocity), (b) standard deviation of the semihourly mean of the momentum flux (friction velocity), (c) semihourly mean of the sensible heat flux, (d) standard deviation of the semihourly mean of the sensible heat flux, (e) semihourly mean of the latent heat flux,

and (f) standard deviation of the semihourly mean of the latent heat flux. The EBBR observation is treated as a parameterization here.

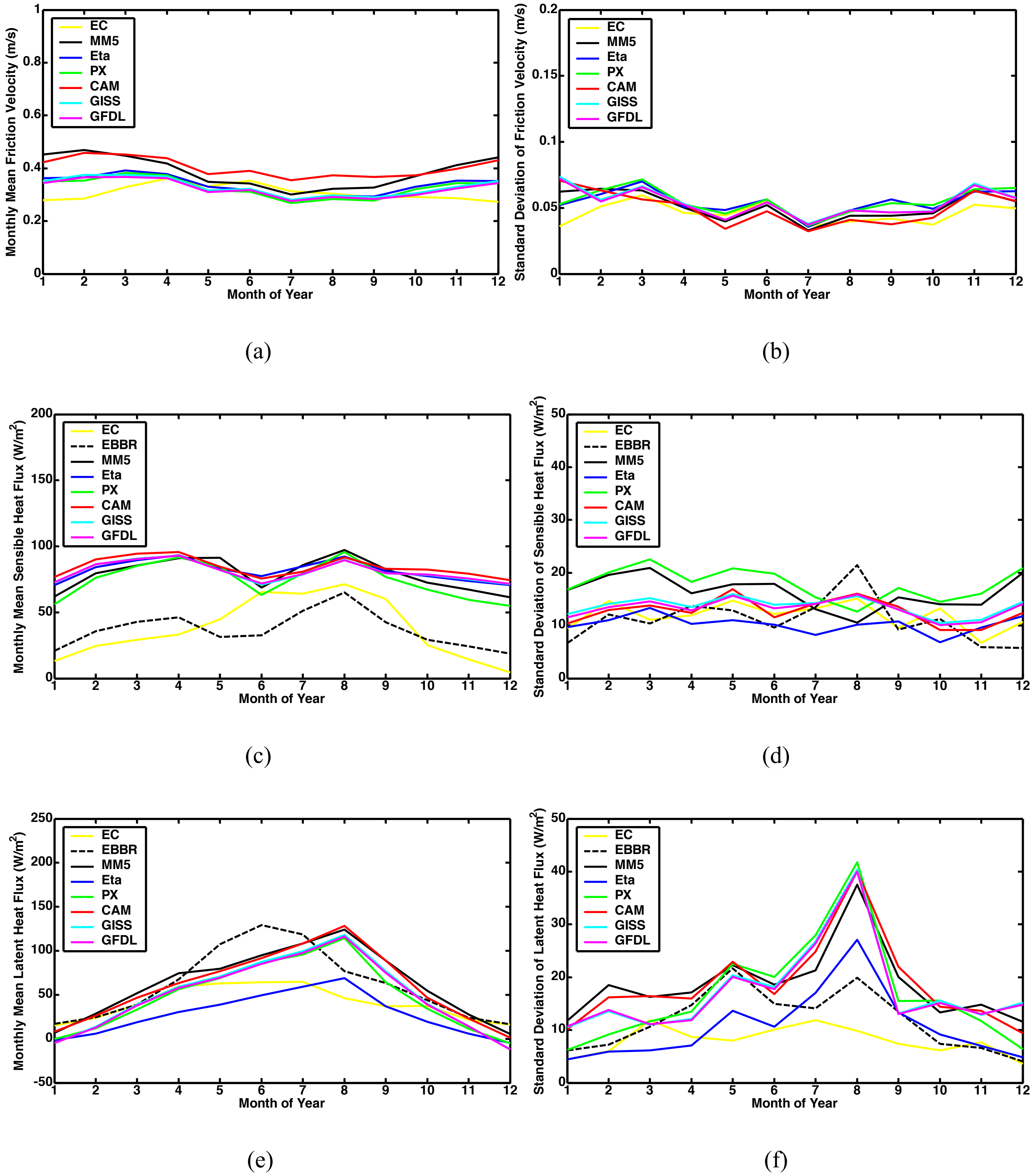
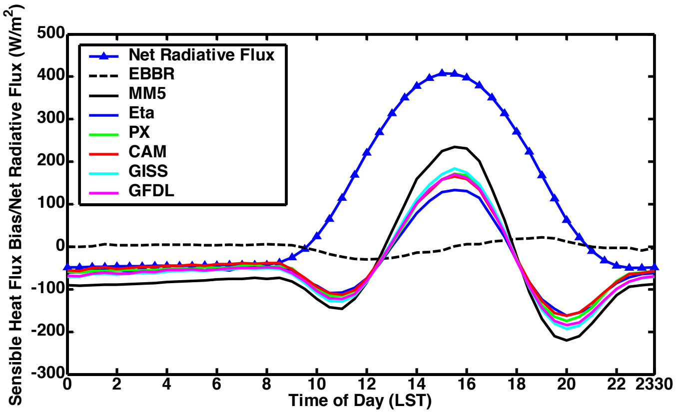
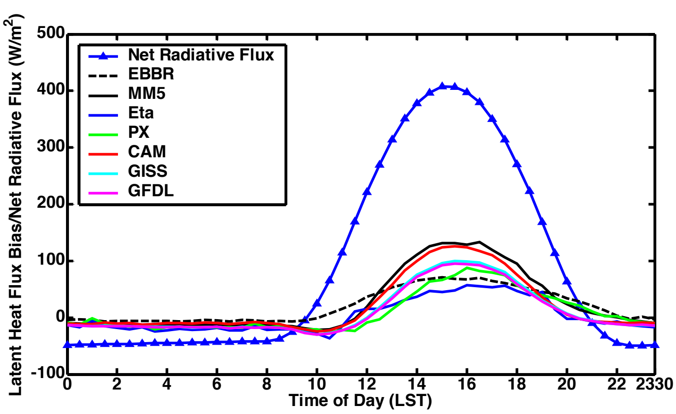


Figure 12. Comparison of seasonal variation of the surface turbulent fluxes between the parameterizations and EC observations: (a) monthly mean of the momentum flux (friction velocity), (b) standard deviation of the monthly mean of the momentum flux (friction velocity), (c) monthly mean of the sensible heat flux, (d) standard deviation of the monthly mean of the sensible heat flux, (e) monthly mean of the latent heat flux, and

(f) standard deviation of the monthly mean of the latent heat flux. The EBBR observation is treated as a parameterization here.





(b) (c)

Figure 15. Semihourly mean of the temperature and flux differences varying with the surface net radiation. (a) The temperature difference is the surface radiative temperature minus the air temperature, and (b), (c) the flux difference is the parameterized surface flux minus the EC-observed surface flux. The EBBR observation is treated as a parameterization here.